Space Weather Technical Forecast

Issued on Saturday, 02 March 2024 at 13:08 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Risk of M or X-Class flares from AR3590 in the northwest declining slowly. Slight chance of G1 Minor geomagnetic storm conditions Days 1-2 (02-03 Mar).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Low during the past 24 hours, with low level C-class flare activity. There are seven sunspot regions on the disc. AR3590 close to the northwest limb remains the largest and most significant potential flare source, with a large delta spot within its intermediate portion remaining visible despite the increasingly foreshortened view. It is likely this region's classification will be maintained as it rotates towards the limb. AR3595 saw some simplification of magnetic structure, with interior spots fading. AR3598 conversely has continued to develop, with mixed polarity growth within the central portion and a Beta-Gamma Mount Wilson structure now apparent. AR3599 near the southeast limb may still reveal additional spots as it rotates further onto the disc. Remaining regions remain smaller and or simpler including the newly numbered AR3600 in the far southeast that appears as a mature unipolar feature.

No Earth directed CMEs were identified in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds as recorded by ACE at L1 were at slow-ambient levels, varying between 300-390km/s, generally on a weakening trend. Density was below average throughout. The interplanetary magnetic field, Bt, was weak throughout, below 6nT. The north-south component, Bz, varied weakly between +3/-4nT, but was mostly southward directed. Phi angle was variable. Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was also at background levels with the associated 24 hour fluence well below the Active (1e8 integrated pfu) threshold. The observed 24-hour fluence at 02/0000UTC was 1.32e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected with isolated M-class flares remaining likely in the near term. There remains a slight chance of X-class flares from AR3590, although through Days 2 and 3 (03-04 Mar) this risk diminishes as AR3590 rotates over the west limb.

Solar Wind / Geomagnetic Activity: There are three recent CMEs which are all most likely to largely miss Earth, but with a risk of some glancing influence later on Day 1 (02 Mar) or early Day 2 (03 Mar). Otherwise no notable solar wind enhancements are expected.

Geomagnetic activity is therefore forecast to be mostly Quiet (Kp 1-2), perhaps increasing to give Unsettled to Active (Kp 3-4) intervals with any CME influence on Days 1 and 2, with a slight chance of isolated G1/Minor Geomagnetic storm intervals (Kp 5).

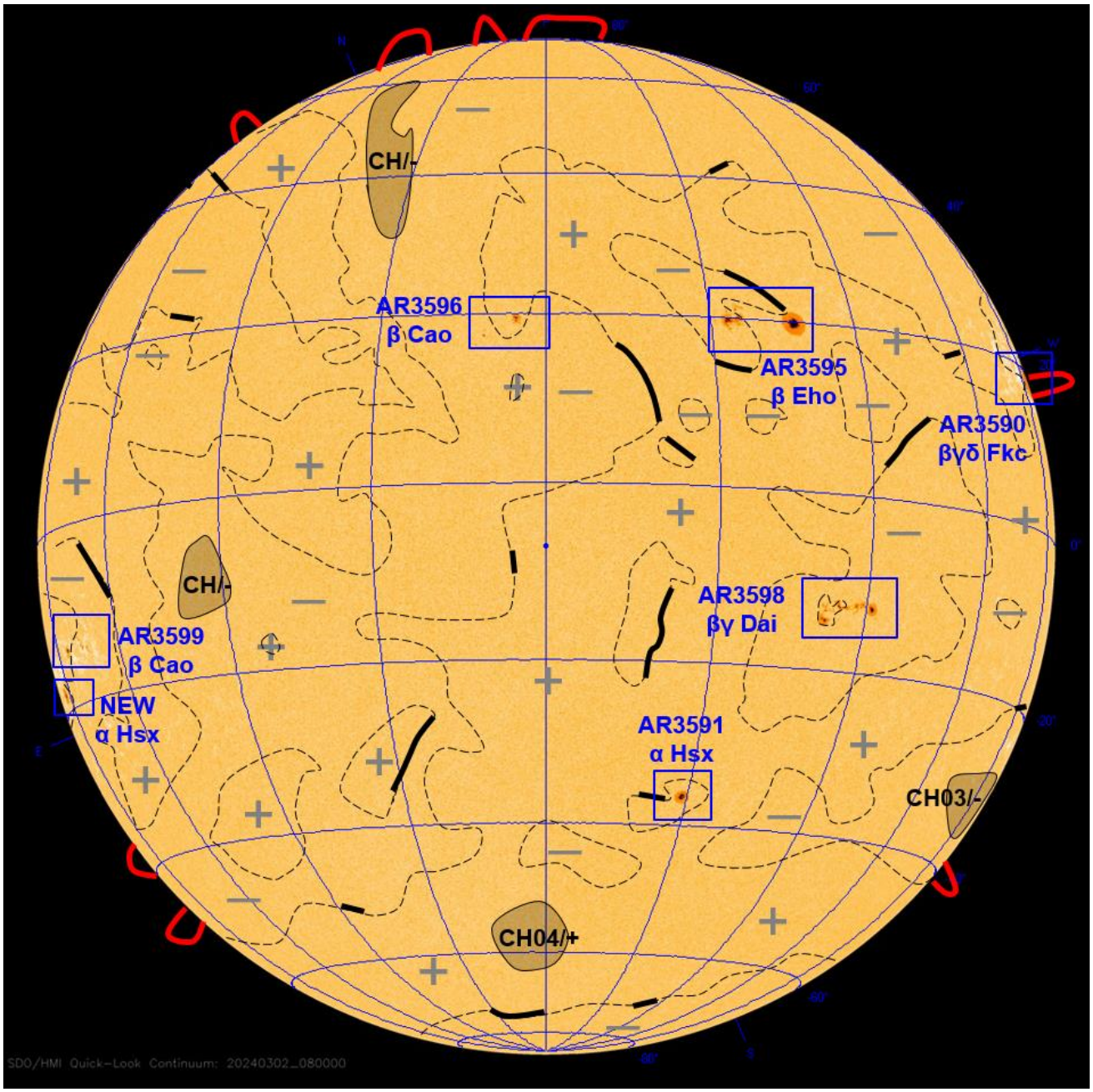
Energetic Particles / Solar Radiation: GOES18 high energy proton flux is likely to stay at background levels, but with a slight chance of rising above S1 levels in response to any notable

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

flares from AR3590 even as this region rotates beyond the western limb. GOES16 high energy electron flux is expected to remain at background levels with the associated 24hr fluence remaining well below the Active threshold throughout.

Figure 1. Solar Analysis Valid 02/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms:

There are three recent CMEs which have been considered potentially Earth directed - one from 27 Feb and two from 28 Feb. All are thought most likely to largely miss Earth, but with a risk of some glancing influence later on Day 1 (02 Mar) or early Day 2 (03 Mar).

Solar winds in the absence of any CME enhancement are expected to remain predominantly at background levels, with the expected absence of significant coronal hole influence. MOSWOC ENLIL output viewed as providing reasonable guidance.

Geomagnetic activity is therefore forecast to be mostly Quiet (Kp 1-2), perhaps increasing to give Unsettled to Active (Kp 3-4) intervals with any CME influence on Days 1 and 2, with a slight chance of isolated G1/Minor Geomagnetic storm intervals (Kp 5).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	10	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

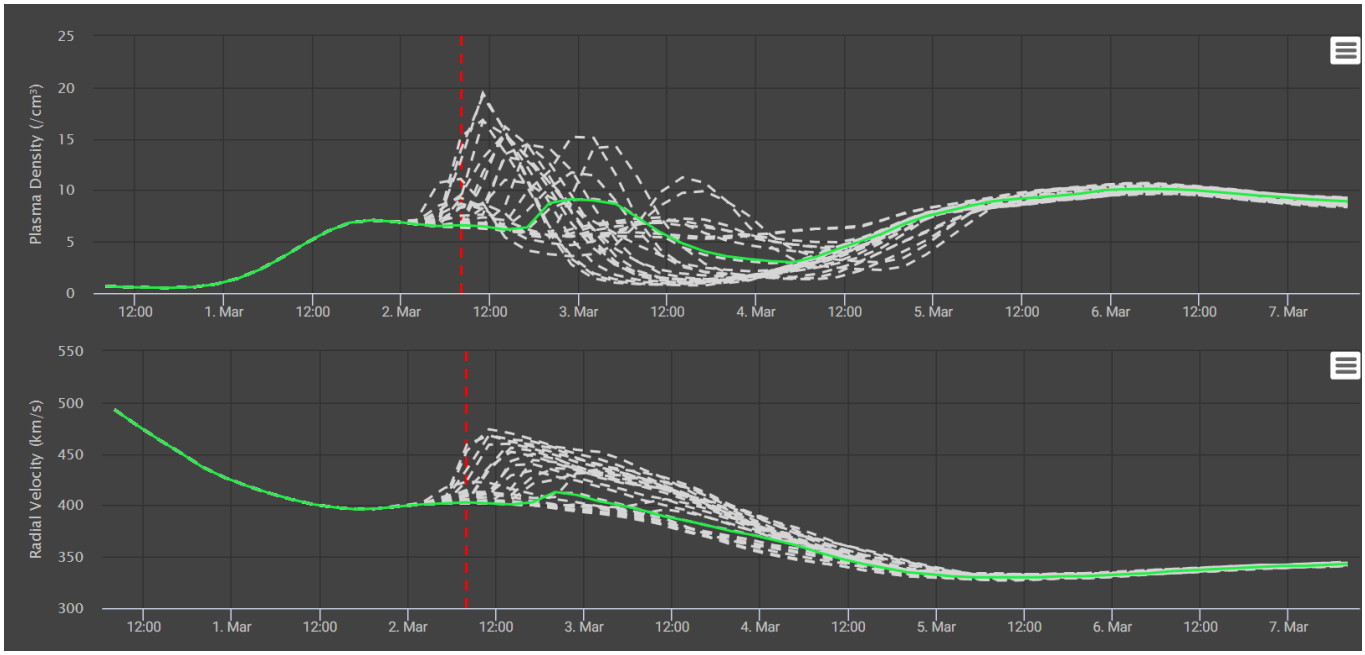
Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
27/1856	Partial	Filament	South Centre	450 km/s	02/2400 UTC	Glancing blow possible
28/1335	Partial	Filament	Southeast	750 km/s	02/1800 UTC	Glancing blow possible
28/1743	Partial	Uncertain	Northeast	460 km/s	02/2100 UTC	Glancing blow possible

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 2: Latest MOSWOC Enlil Ensemble output, indicating numerous, but generally weak CMEs forecast between 02-03 March.



Radio Blackouts - X-Ray Flares:

Although solar activity has been Low over the past 24 hours, with only low level C-class activity, isolated M-class flares are still considered likely in the near term, with a slight chance of X-class flares from AR3590 given the complexity and history of this region. AR3590 will rotate off the disc late on Day 1 (02 Mar), with the risk of flares then slowly declining in the coming days, although the chance of an isolated M-class flare remains from other active regions on the visible disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	60	60	40	30
Very Active	R3 to R5 X Class	No	15	15	5	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

GOES-18 proton flux is currently at background levels, and is likely to remain so through this period. However, there is a slight chance of enhancement from any major flare associated with AR3590 as it approaches and crosses the northwest limb during the period. This risk only easing towards the end of the period as this region rotates sufficiently onto the far side. The slight risk also bolstered by the presence of other active regions in the western hemisphere throughout.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	15	15	15	10
Very Active	**≥ S3 ***	No	5	5	5	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES-16 is currently at background levels. With the absence of significant coronal holes in the forecast, and only glancing CME influence expected, little change is forecast.

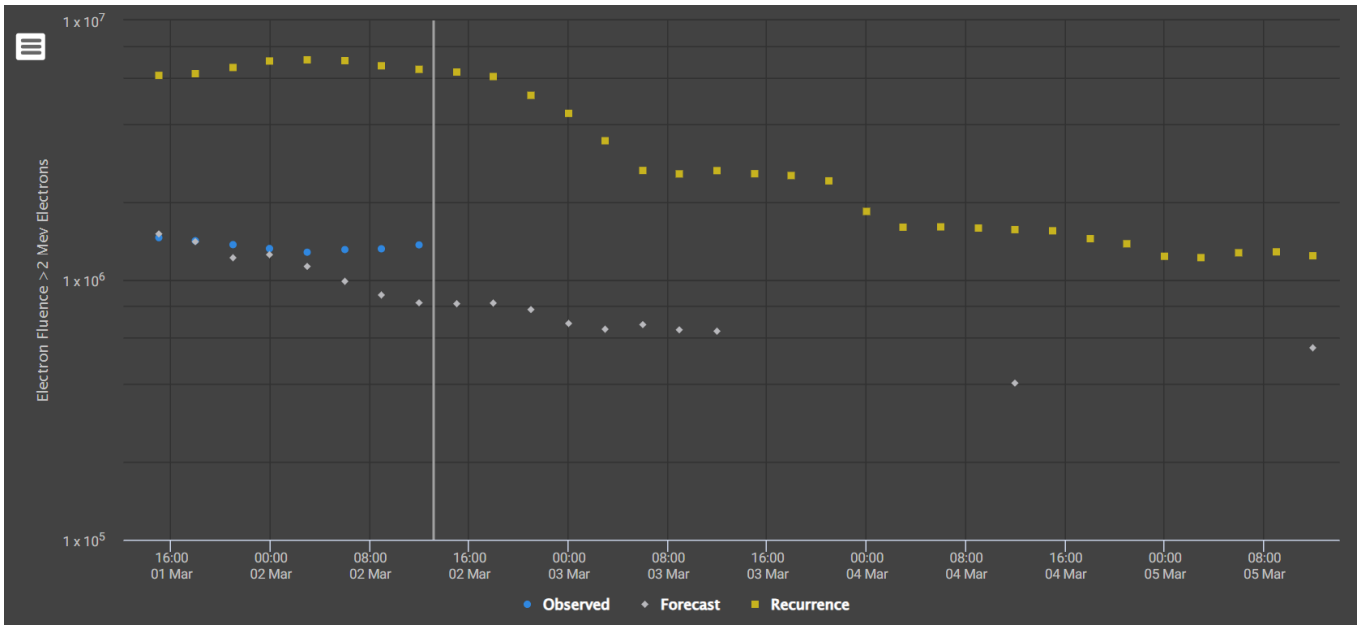
The associated 24 hour fluence is expected to stay well below the Active (1e8 integrated pfu) threshold. MOSWOC REFM is currently thought to be giving reasonable guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 3: Latest MOSWOC REFM output and recurrence.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.